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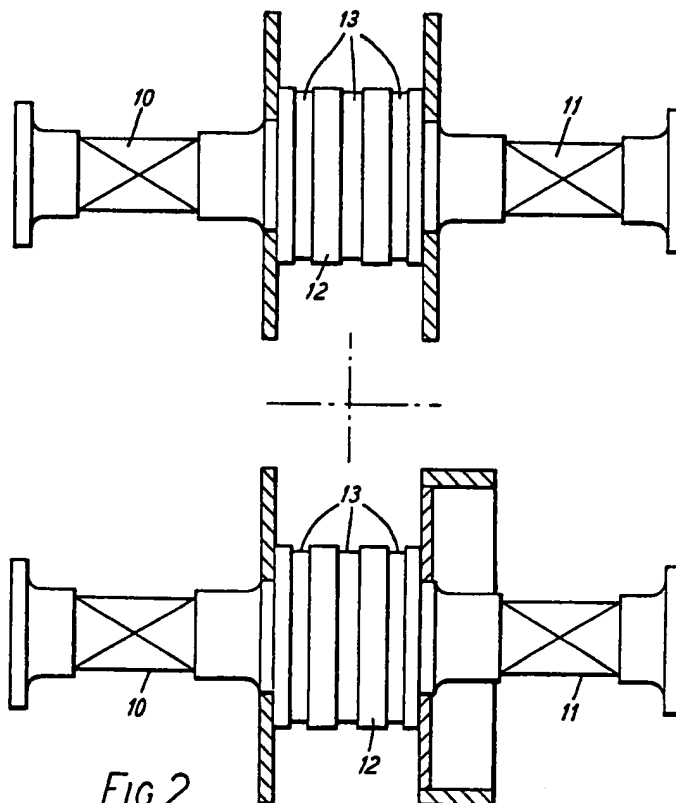
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(58) Field of search

F2U

(54) **Winding shaft for mine
winders, hoists and lifts**

(57) A mine winder, hoist or lift is provided with a shaft forging formed with an integral rotor body 12 which is machined to form a plurality of grooves 13 suitable for receiving flat ropes of the kind defined and with a bearing surface 10, 11 on each side of the rotor body.



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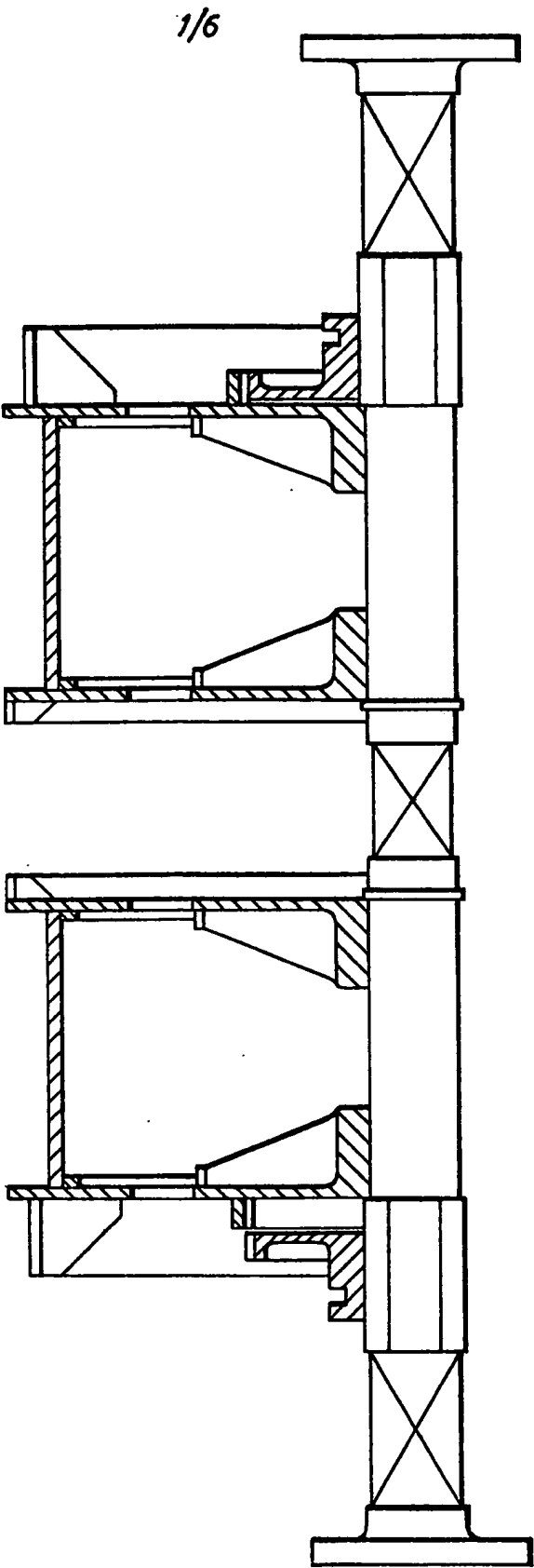


FIG. 1

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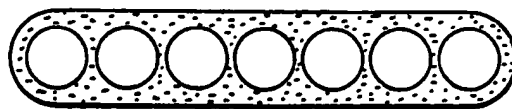
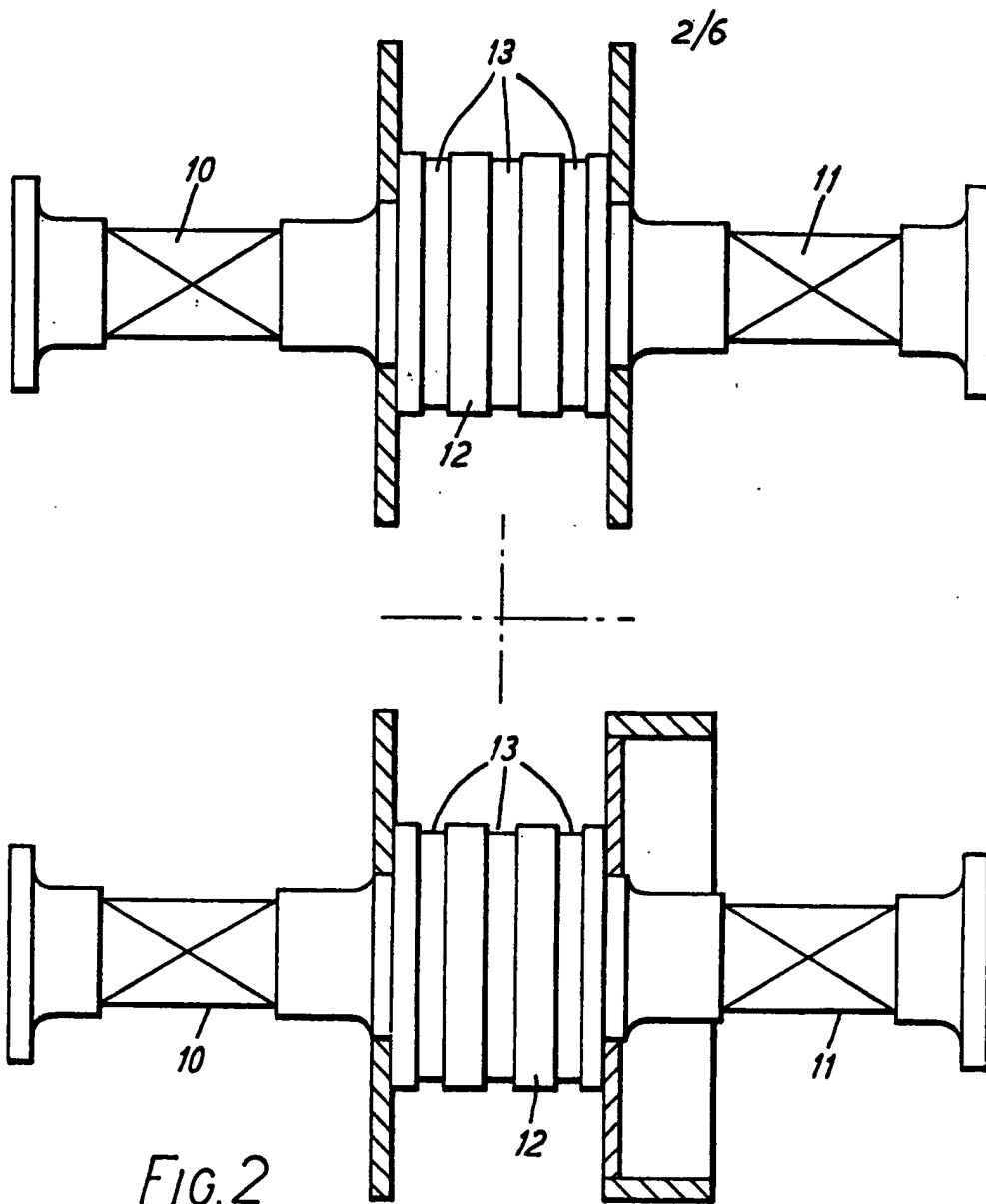
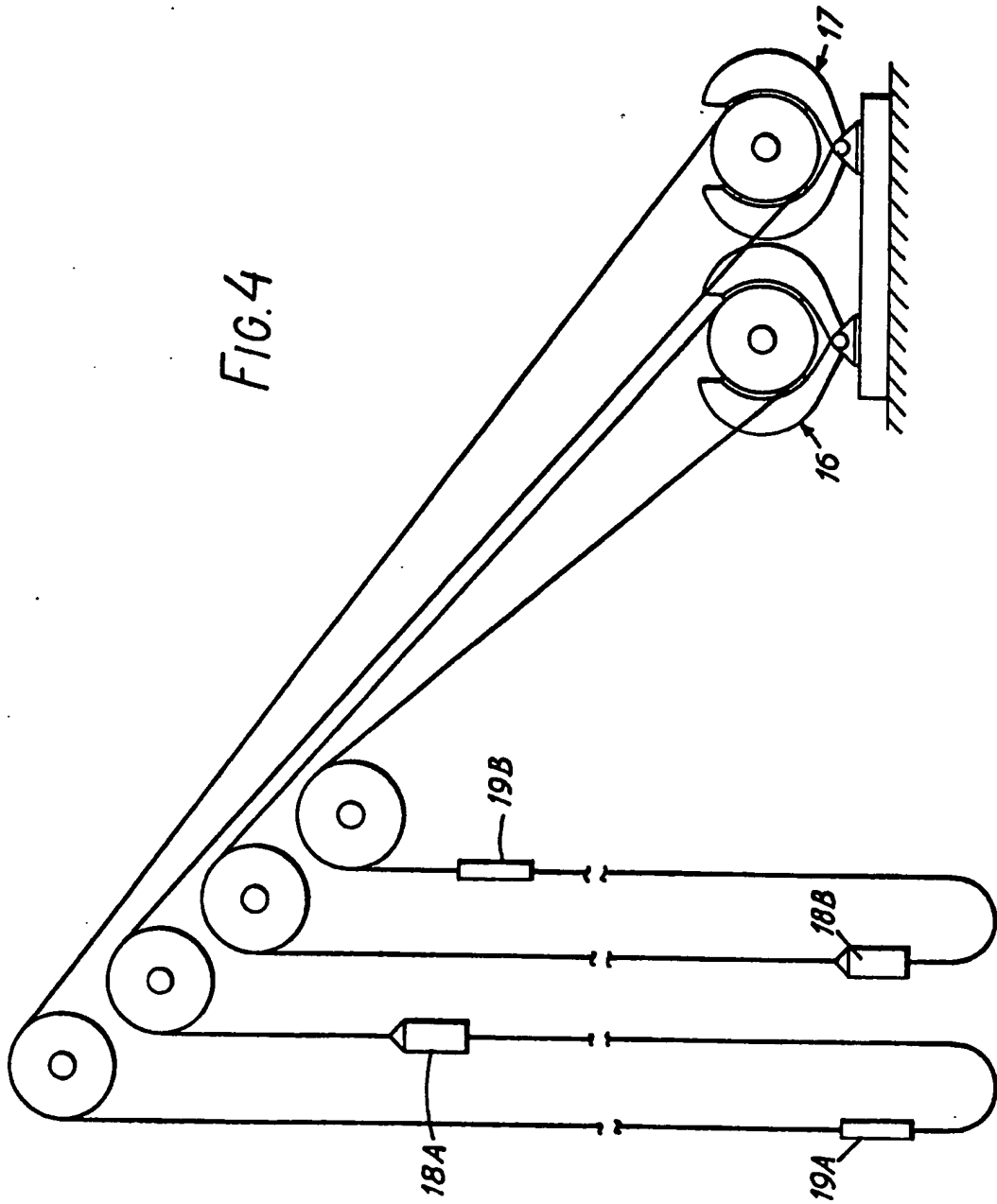
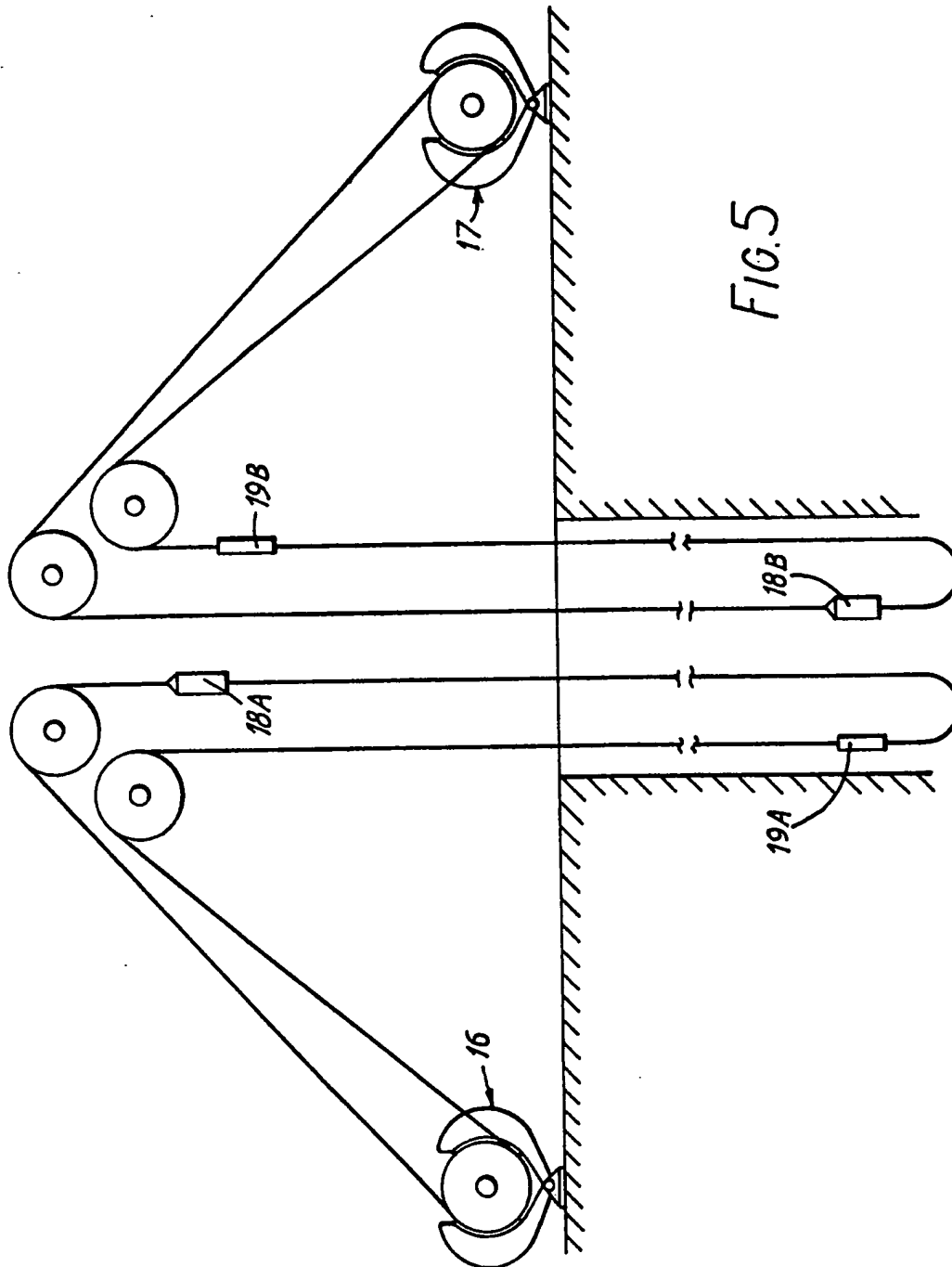


FIG. 4





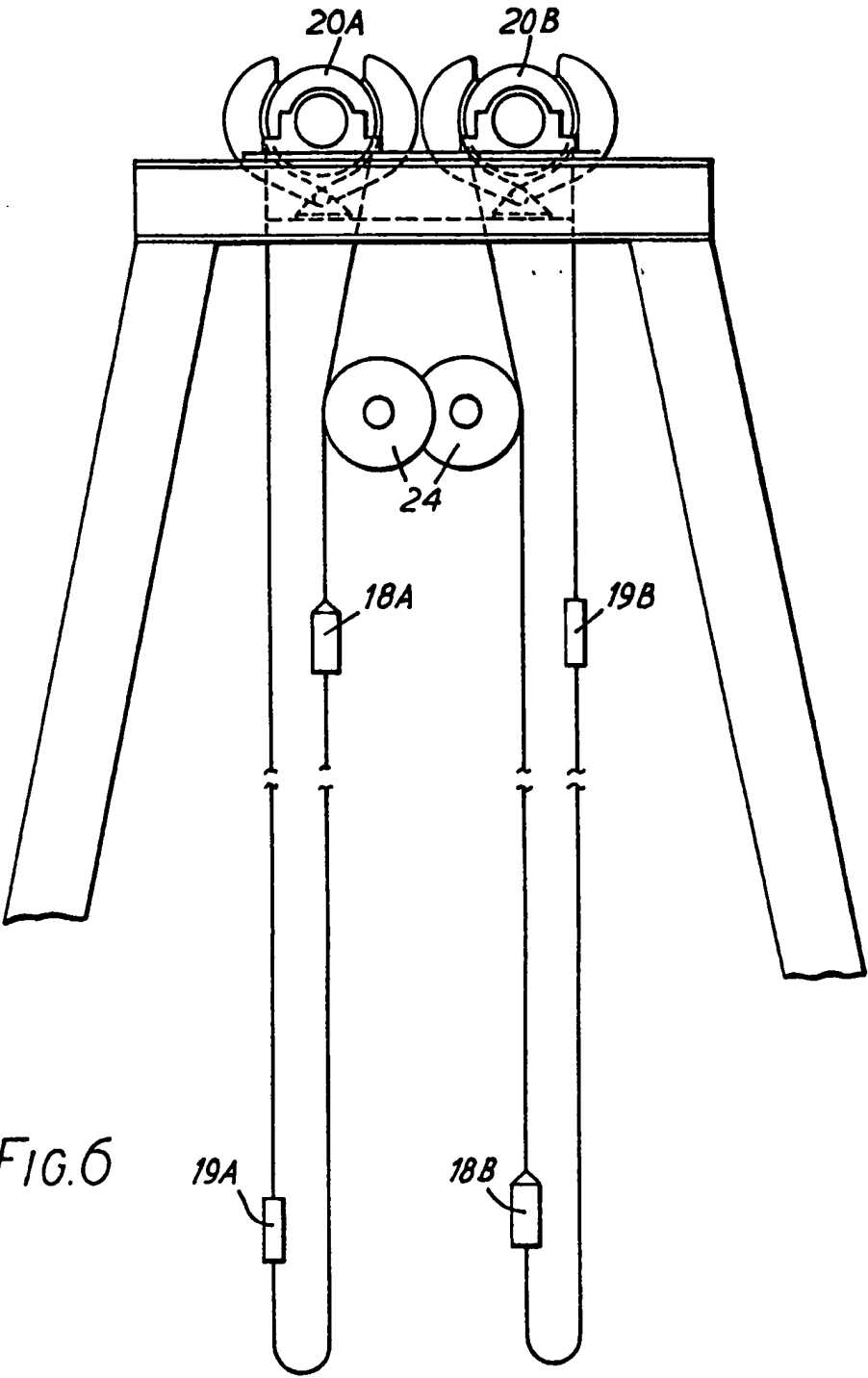
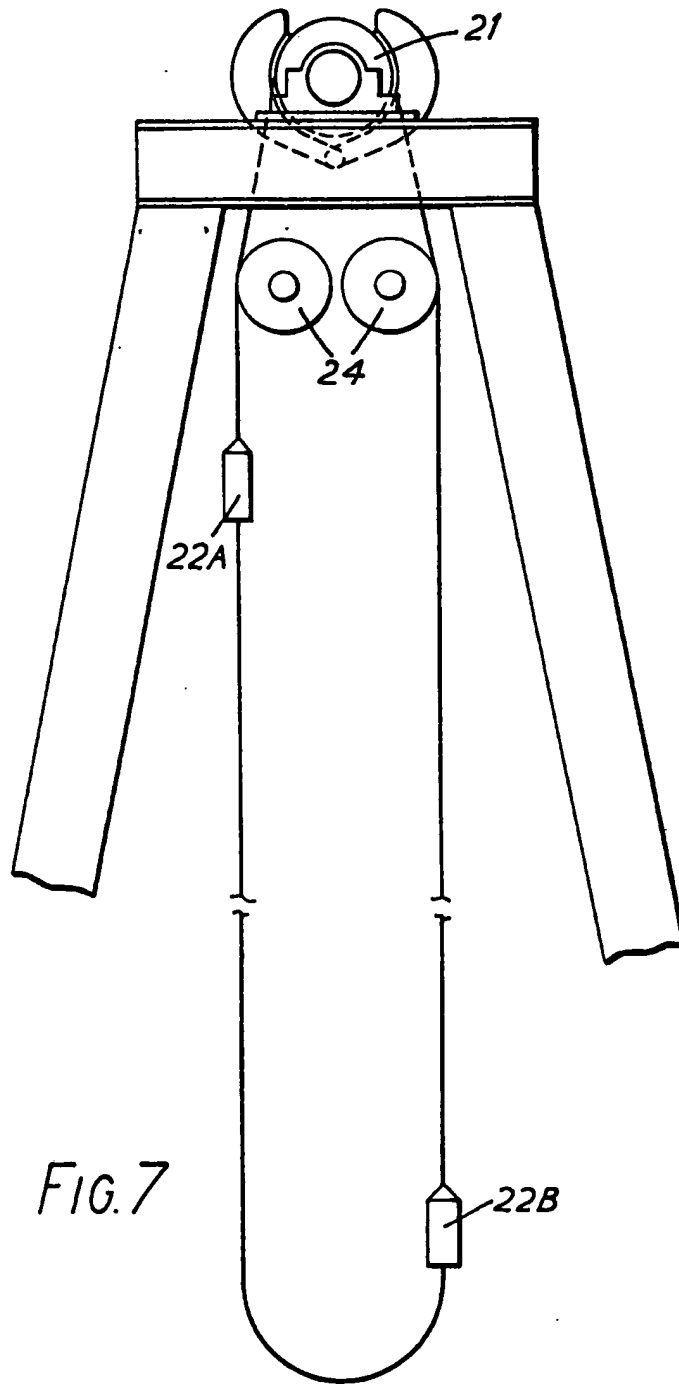


FIG. 6



SPECIFICATION

Improvements to mine winders, hoists and lifts

5 This invention relates to mine winders hoists and lifts e.g. to winding engines such for example as those installed in coal mines and gold mines. Such winding engines or hoists are provided with drums, which are commonly formed by two annular discs mounted on a shaft and spaced apart and connected together by a cylinder over which the winding ropes pass. The object of the present invention is to provide an improved form of drum.

10 Patent application No. 2134209 describes a flat rope construction comprising at least two ropes on to which a cover of elastomeric material is bonded and formed into a flat cross-sectional shaped rope. The flat rope may have teeth formed on one or both flat sides for the purpose of engaging with teeth formed on the circumference of the winding drum with the object of preventing slip or creep of the rope under the influence of acceleration or retardation.

According to the present invention a shaft forging is formed with an integral rotor body which is machined to form a plurality of grooves suitable for receiving flat ropes of the kind defined and with a bearing surface on each side of the rotor body.

The diameter of the rotor body is preferably two to three times the diameter of each bearing surface.

The flat ropes may each contain for example 3 to 6 ropes.

In order to increase the grip of the flat ropes on the drive rotor/s, treads similar to the tyre treads used in the automobile industry may be formed on one or both flat sides of the flat ropes.

In one example two forged steel rotors are employed either clutched and geared together or electrically coupled, each using a plurality of flat ropes and suspending a cage or skip on one end of the ropes and counterweight on the other, preferably using a balance rope for multi-level winding.

The counterweight is made up of as many separate weights as there are flat ropes and each weight is dovetailed and slideable in each other for the purpose of ensuring that the tension on each belt remains the same throughout the working life of the ropes.

Calculations which compare the Root mean squared H.P. required to operate the same time cycle and raising the same payload for a conventional 16'-0" diameter Double Clutched Drum Winder against a Double Flat Rope Rotor Winder show that the same output can be achieved at approximately three quarters of the H.P. This means that the running cost over, say, a 20 year life would be very considerable.

In order to facilitate making such a rotor body it is desirable to provide a sufficient number of ropes of small enough diameter to enable the rotor body to be of relatively small diameter e.g. 80 to 100 times the diameter of a rope.

It can be shown that such a design can greatly reduce the cost of construction. As an example a 16'-0" diameter double clutched drum winder of known construction has drums weighing some 125 tons mounted on a drum shaft itself weighing 25 tons. With the construction according to the present invention, the weight of the forged shaft would be approximately twelve and a half tons or if two shafts are used would be in the order of 25 tons.

Figure 1 shows the sort of known construction required for 16'-0" diameter drums coiling two single ropes.

Figure 2 shows to the same scale the proposed new construction from which it will be seen that the hoist itself consists of a single forged steel shaft having two bearing surfaces 10, 11 and a solid centre rotor body 12 on to which are turned a number of rope tracks 13 suitable for taking the flat moulded multi-rope constructed winding ropes as shown in section in Fig. 3 with or without teeth or treads formed on either or both flat faces.

By way of example, the 16'-0" twin rope hoist of Fig. 1 would have a winding rope 1.7/8" or 2" diameter.

For the present invention if 4 ropes are used, the diameter of the drum may be halved assuming that in both cases the drum diameter is 100 times the diameter of each rope in the flat rope to be wound on to it. If eight ropes or two flat ropes each having four ropes were used, the diameter of the drum would be a quarter that of the 16'-0" diameter drum, namely 4'-0".

From this it will be appreciated that using sufficient number of ropes the drum diameter can be reduced to the point where no drum structure of the sort illustrated in Fig. 1 is required but a solid shaft as shown in Fig. 2 can be substituted, the diameter of which can be proportioned to match the bearing diameters which will be roughly the same for either construction of hoist. For instance if the bearing diameter determined on the load to be carried works out to be say 18", then a convenient diameter for the body of the shaft forging would be 3'-0" to 3'-6". Supposing 3'-6" is chosen, the diameter of the ropes in the belts should be no more than 0.42" diameter, the nearest flattened strand rope is 7/16" diameter having a breaking strain of 8.3 tons. The 2" rope used for the 16'-0" diameter drum has a breaking strain of 179 tons therefore the number of 7/16" diameter ropes having the equivalent strength would be 20.48 ropes, say 21. To meet the operating

requirements of the hoist, 3 flat ropes each containing seven 7/16" diameter ropes would meet the requirement. Such a flat rope would require a track 3.3/4" wide 5/8" deep turned in the solid body of the shaft.

Figs. 4, 5, 6 and 7 show alternative arrangements using solid forged steel rotor drives such as described for Fig. 2. Figs. 4 and 5 show two ground mounted hoists each operative 18A, 18B a cage and counterweight 19A, 19B hoist capable of operating at any number of levels. In the case of Fig. 4, the rotors of the hoists can be geared together involving a clutch or the rotors can be electrically coupled without the need for a clutch. Fig. 6 shows two rotors 20A, 20B tower mounted and capable of operating at any number of levels and either geared together or electrically coupled as in the case of Fig. 4.

Guide pulleys 24 may or may not be required. Fig. 7 shows a single rotor for operating to fixed shaft depth having a cage or skip 22A, 22B attached to each end of the flat ropes. Because of the small diameter of the rotor, it would probably be necessary to use two guide pulleys to obtain the correct pitch for the cages of skips. Because of the reduced angle of contact of the ropes on the drive rotor, it may be necessary in this case to use teeth of one form or another on the flat ropes or a suitable tread could be formed on one or both sides of the flat rope to increase the unit pressure.

Because of the small rotor diameter relatively high speed motors directly coupled to the rotor can be used thus reducing the physical size of the motors required. For example, a 16'-0" diameter single rope winder hoisting at 60 ft/sec. would require a 60 RPM motor whilst a 3'-6" diameter multi-rope drive rotor would require 327 RPM resulting in a very much smaller motor.

Hoist arrangements such as those shown in Figs. 4, 5 and 6 would require a minimum of two motors or a maximum of four motors, again reducing the physical size of the motors required.

A further advantage of the invention is that hoist maintenance is reduced to just two bearings, the rotor remaining almost indestructible. Any wear would be on the flat ropes themselves which in any case have only a limited life as defined by the Mines Act of Parliament. The ropes should of course last longer than the bare rope/s normally employed being protected by the resilient rubber-like covering which not only protects against physical destruction but retains the original grease put in by the rope manufacturers.

CLAIMS

1. A shaft forging formed with an integral rotor body which is machined to form a plurality of grooves suitable for receiving flat ropes of the kind defined and with a bearing

journal on each side of the rotor body.

2. A shaft forging as claimed in Claim 1, wherein the diameter of the rotor body is two to three times the diameter of each bearing journal.

3. A shaft forging as claimed in Claim 1 or 2 wherein the rotor body is 80 to 100 times the diameter of the individual ropes in the flat ropes.

4. A shaft forging as claimed in claim 1, 2 or 3, substantially as described with reference to Fig. 2 of the accompanying drawings.

5. A mine winder, hoist or lift having a shaft forging as claimed in any of claims 1 to 4 and provided with flat ropes of the kind defined operating in said grooves.

6. A hoist system having two ground or tower mounted hoists each operating a cage and counterweight over pulleys, each hoist including a shaft forging as claimed in any of claims 1 to 4 and provided with ropes of the kind defined in said grooves.

7. A hoist system comprising a tower mounted hoist provided with a shaft forging as claimed in any of claims 1 to 4 and provided with ropes of the kind defined in said grooves, the ends of the ropes being attached to two cages or skips.

8. A hoist system substantially as illustrated in any of Figs. 4 to 7 of the accompanying drawings.

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